# Comparison of Radiographic Measurement and Clinical Parameters of Periodontal Condition on Premolars and Molars

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## I. INTRODUCTION

In daily practice, general practitioners and periodontists depend on both radiographic and clinical measurements for obtaining information about the extent of bone loss and diagnosis of severity of disease.

Dental radiography has long been considered to be one of the cornerstones in proper diagnosis of dental disease and disorder. Swam & Lewis(1993)[1] have investigated the actual use of radiographs in practice and have determined for each patient and risk type, there were considerable variation in the radiographs prescribed.

In the early years of the twentieth century, the dental radiography was useful in revealing destruction of osseous tissue[2, 3, 4]. However, Prichard(1961)[5], Burnette(1971)[6], Goldman (1973)[7], Lang & Hill(1977)[8] began to question the value of radiography. They pointed out that the radiography was of limited value. Conversely, other writers[9,-12]have stressed radiographic interpretation as essential for the adequate diagnosis of periodontal conditions.

Studies by Orban(1960)[13], Rees(1971)[14], Brägner(1996)[11] showed the necessity for the correct interpretation and an improved education in the field of radiography to make its role useful for dental practice.

Although the radiography plays a significant role in periodontal treatment planning and prognosis, it must be used in combination with a detailed evaluation of the pocket depth and attachment loss.

Russel(1956)[15] scored each tooth according to the clinical condition of its supporting tissues. He first determined clinical conditions and then other supplying additional information from radiography gave him the degree of bone loss around the teeth. He stated that using clinical observations alone would underestimate the condition in three to ten percent of the cases.

Suomi(1973)[12] made a comparison study and he obtained the average differences between alveolar bone loss determined by surgical procedures and by radiographic measurement. He found closer agreement in the anterior segment of the lower arch than in other areas of the mouth. Their data showed that values obtained from periapical radiography were about 1mm lower than those obtained directly at surgery. Radiographic measurement was more closely to the surgical measurement than did the pocket measurement. However, his study required from patients to undergo a surgical procedure which was impractical as a routine diagnostic method

There is, however, some disagreement about the value of correlation of radiographic and clinical measurements. Renvert et al(1981)[16] showed that the radiographic bone height had a lower degree of correlation with the bone height measured during surgery than the results of probing before surgery. For example, Hammerle & Lang(1990)[17] said that when comparing radiographic bone heights with clinical measurement of probing attachment loss, low correlation were found. On the other hand, Lang & Hill(1977)[8] demonstrated that there was no significant difference between radiographic and clinical measurements. An article was published by Hausmann et al(1994)[18] in which they found a direct and significant relationship and a concordance in radiographic bone height and probing attachment loss.

These differences of results are worthy of consideration. Depending on the section of the mouth and type of teeth to be consider as the sample and the score system used to study, can contribute to significant differences in measured values.

The validity and the reproducibility of periodontal probing has been evaluated extensively in single rooted teeth[19, 20, 21]. This validity has been determined by establishing the location of the probe tip when the crevice depth or attachment level is measured.

The reproducibility has been shown to vary among patients, tooth type, pocket depth, tooth site, bleeding or non-bleeding site and among trained examiners[22-25].

Diagnosing periodontal breakdown around multirooted teeth, specifical attention has to be paid to the furcation since disease progression is usually most pronounced at this site. However, due to the complicated anatomy of this area, the possibility of radiographic demonstration of bone loss indicating furcation involvement may be limited.

Intraoral radiographic are generally preferred due to their sharpness and ability to demonstrate structural details[9, 10, 26]. Several reports have described periodontal destruction in terms of alveolar bone loss assessed from x-ray[4, 10, 22, 23, 27]. In posterior area, the panoramic radiography presented more adequate density and accuracy than in anterior region and the interpretation of the bone level is easily measured[26, 28]. When using radiographic in clinical diagnosis, it has to be kept in mind that a three-dimensional object is projected onto a two-dimensional plane resulting in a complex picture of different anatomical structures superimposed on each other.

The reason for early and frequent molar loss is furcation involvement. Furcation involvement results from loss of periodontal fiber attachment and bone between the roots of multirooted teeth. The clinician does not know to what extent his clinical diagnosis reflects the underlying bony furcation defect.

Knowing this relationship would help to have a diagnosis and prognosis.

The present study was a statistical comparison to determine, the correlations between clinical and radiographic measurements of premolars and molars in assessing periodontal destruction. Measurement of periodontal probing depth and attachment loss were compared to investigate their correlation with alveolar bone level by radiographic measurement. Molars with furcation are analysed in separated manner.

## II. SUBJECTS AND METHODS

### 1. Subjects

Hundred and thirty patients who came to the Department of Periodontology in Yonsei University were selected for this study. They did not suffered from systemic disease or alteration in occlusion harmony and they did not received orthodontic treatment. The selected teeth were the premolars and the molars from upper and lower arch and were scored mesial and distal sites of the premolars and mesial, middle and distal sites of the molars. Caries, crowns or other reconstructions that had covered the cementoenamel junction and third molars were excluded.

### 2. Methods

(1) Clinical measurements

The probing pocket depth(P.D) was measured on the interproximal and middle sites, recording the deepest site from the buccal and the lingual. It was measured the distance from the gingival margin to the base of the pocket and was expressed in mm by Williams probe(Hu-Friedy) and the fraction of mm were disregarded because distance smaller than 1mm were difficult to measure. The probing attachment loss(A.L) was measured at the same sites with the same probe. It was measured the distance from the cementoenamel junction to the base of the pocket.

### 2. Radiographic measurement

Panoramic radiographs were used for the assessment of the alveolar bone level from the cementoenamel junction(Rx.B.L.). It was expressed in mm by the same periodontal probe used for clinical assessments.

Radiographic interpretation was performed in a darkened room which no reflected light was present. The criteria of accuracy advocated by Prichard[5] were used as standards for determining acceptance of the radiography.

The radiolucency space in the intra-radicular area from the roof of the furca to alveolar crest was assessed for the measurement of the furca involvement.

### 3. Statistical Study

The coefficient of correlation between P.D, A.L and Rx.B.L. were analyzed with Pearso's correlation test.

## III. RESULTS

### 1. The mean of measurements of interproximal area

The interproximal score for each teeth was computed by averaging the scores for the mesial and distal site.

The mean probing depth(P.D) and attachment loss(A.L) in the upper arch were from 5.63±1.87mm to 3.73±1.35mm, and from 5.64± 1.99mm to 3.76± 1.24mm, respectively.

In upper right second molars (UR2M) the P.D was 5.63±1.87mm and the A.L was 5.64 ±1.99mm. They presented the highest value, followed by left second molars(UL2M) with P.D: 5.47±2.17mm and A.L: 5.53±2.43mm, right first molars (UR1M) with P.D: 5.42± 2.08mm and A.L: 5.50±2.12mm, left first molars (UL1M) with P.D: 5.27±2.00mm and A.L: 5.39±1.96mm, left second premolars (UL2PM) with P.D: 4.39±1.60mm and A.L: 4.49± 1.59mm, right second premolars (UR2PM) with P.D: 4.12±1.70 and A.L: 4.13±1.68mm, right first premolars (UR1PM) with P.D: 3.97±1.79mm and A.L: 4.09± 1.66mm, and left first premolars (UL1PM) with P.D: 3.73±1.35mm and A.L: 3.76± 1.24mm were in respective order.

In lower arch, the mean P.D was from 4.88 ±1.63mm to 3.42±1.06mm and A.L was from 4.91±1.71mm to 3.48±1.25mm The lower right second molars(LR2M) was the highest, followed by LR1M, LL1M, LL2M, LR2PM, LL2PM, LR1PM, and LL1PM in respective order(Table 1).

The mean radiographic measurement in upper arch was from the highest value of UR2M with 5.05±2.35mm to the lowest value of UR1M with 4.15±2.46mm. In lower arch the highest value was in LR2M with 4.96±1.71mm and the lower was in L1PM with 3.96±1.34mm(Table 1).

## 2. The mean of measurements of furcation involvement

The mean pocket depth at the middle site(P.D(c)) was from the highest value of LL1M with 7.11±2.21mm to the lowest value of UL1M with 4.37±2.08mm(Table 4).

The mean attachment loss at the middle site (A.L(c)) was from the highest value of LL1M with 8.06±2.14mm to the lowest value of UL1M with 4.46±2.2.mm(Table 5).

The mean radiographic bone level at the furca (RxB.L(f)) was from the highest value of 2.05±1.30mm to the lowest value of 0.25± 0.73mm(Table 4-5).

## 3. The correlation in interproximal area

The correlation between P.D and Rx.B.L :

The mean values and the coefficient of correlation is showed in table 2. The correlation were high in all teeth. The highest was in LR1M with r=0.897 to the lowest in UL1PM with r=0.725. ($p<0.01$).

The correlation between A.L and RxB.L :

The mean values and the coefficient of correlation is showed in table 3. The correlation were high in all teeth. The highest was in LR1M with r=0.915 to the lowest in UL1PM with r=0.732($p<0.01$).

## 4. The correlation in furcation area

The correlation between P.D(c) and Rx.B.L(f) :

The mean values and the correlation are showed in table 4. The coefficient of correlation for each teeth was very high ( from r=0.811 to r=0.435.($p<0.01$)) for the

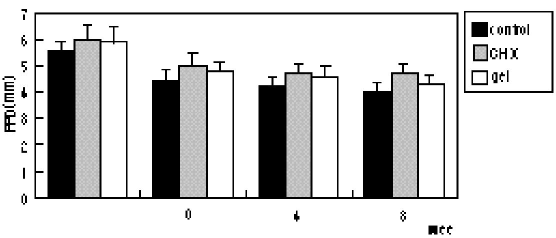
* Tooth type according to F.D.I.'s two digit system of designating teeth(Int Dent J 21: 104, 1981).

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 |

**Table 1 Mean value of interproximal site of each teeth in the three measurements** (Mean ±S.D)

| Tooth type. / measuremetns | 17(85) mean±S.D | 16(103) mean±S.D | 15(105) mean±S.D | 14(101) mean±S.D | 24(85) mean±S.D | 25(89) mean±S.D | 26(92) mean±S.D | 27(76) mean±S.D |
|---|---|---|---|---|---|---|---|---|
| A.L | 5.64±1.99 | 5.50±2.12 | 4.13±1.68 | 4.09±1.66 | 3.76±1.24 | 4.49±1.59 | 5.39±1.96 | 5.53±2.43 |
| P.D | 5.63±1.87 | 5.42±2.08 | 4.12±1.70 | 3.97±1.79 | 3.73±1.35 | 4.39±1.60 | 5.27±2.00 | 5.47±2.17 |
| Rx.B.L | 5.05±2.35 | 4.15±2.46 | 5.01±1.98 | 4.25±2.36 | 4.52±1.81 | 4.98±1.95 | 4.78±2.28 | 4.86±2.60 |
| Tooth type. / measuremetns | 47(89) mean±S.D | 46(114) mean±S.D | 45(63) mean±S.D | 44(62) mean±S.D | 34(73) mean±S.D | 35(75) mean±S.D | 36(115) mean±S.D | 37(95) mean±S.D |
| A.L | 4.91±1.54 | 4.65±1.68 | 3.89±1.35 | 3.66±1.28 | 3.48±1.25 | 3.87±1.39 | 4.43±1.30 | 4.39±1.31 |
| P.D | 4.88±1.63 | 4.62±1.68 | 3.85±1.42 | 3.65±1.34 | 3.42±1.06 | 3.77±1.44 | 4.22±1.14 | 4.21±1.24 |
| Rx.B.L | 4.96±1.71 | 4.86±1.87 | 4.21±1.87 | 4.20±1.96 | 3.96±1.34 | 4.31±1.61 | 4.43±1.30 | 4.51±1.52 |

A.L : Probing Attachment Loss
P.D : Probing Pocket Depth
Rx.B.L : Radiographic Bone Level
( ) : Quantity of teeth




Tooth type according to F.D.I.'s two digit system
( ) : Quanity of teeth

**Fig 1 The comparison between P. D. and A. L. of interproximal site**

Table 2 The comparison between P.D and Rx.B.L of interproximal site (Mean ±S.D)

| Tooth type. / measuremetns | 17(85) mean±S.D | 16(103) mean±S.D | 15(105) mean±S.D | 14(101) mean±S.D | 24(85) mean±S.D | 25(89) mean±S.D | 26(92) mean±S.D | 27(76) mean±S.D |
|---|---|---|---|---|---|---|---|---|
| P.D. | 5.63±1.87 | 5.42±2.08 | 4.12±1.70 | 3.97±1.79 | 3.73±1.35 | 4.39±1.60 | 5.27±2.00 | 5.47±2.17 |
| Rx.B.L | 5.05±2.35 | 4.15±2.46 | 5.01±1.98 | 4.25±2.36 | 4.52±1.81 | 4.98±1.95 | 4.78±2.28 | 4.86±2.60 |
| Correlation Coefficient(r) | 0.792** | 0.789** | 0.759** | 0.738** | 0.725** | 0.788** | 0.783** | 0.815** |
| Tooth type. / measuremetns | 47(89) mean±S.D | 46(114) mean±S.D | 45(63) mean±S.D | 44(62) mean±S.D | 34(73) mean±S.D | 35(75) mean±S.D | 36(115) mean±S.D | 37(95) mean±S.D |
| P.D | 4.88±1.63 | 4.62±1.68 | 3.85±1.42 | 3.65±1.34 | 3.42±1.06 | 3.77±1.44 | 4.22±1.14 | 4.21±1.24 |
| Rx.B.L | 4.96±1.71 | 4.86±1.87 | 4.21±1.87 | 4.20±1.96 | 3.96±1.34 | 4.31±1.61 | 4.43±1.30 | 4.51±1.52 |
| Correlation Coefficient(r) | 0.854** | 0.897** | 0.725** | 0.744** | 0.734** | 0.769** | 0.762** | 0.808** |

P.D : Probing Pocket Depth
Rx.B.L : Radiographic Bone Level
** : $p<0.01$

Table 3 The comparison between A.L and Rx.B.L of interproximal site (Mean±S.D)

| Tooth type. / measuremetns | 17(85) mean±S.D | 16(103) mean±S.D | 15(105) mean±S.D | 14(101) mean±S.D | 24(85) mean±S.D | 25(89) mean±S.D | 26(92) mean±S.D | 27(76) mean±S.D |
|---|---|---|---|---|---|---|---|---|
| A.L | 5.64±1.99 | 5.50±2.12 | 4.13±1.68 | 4.09±1.66 | 3.76±1.24 | 4.49±1.59 | 5.39±1.96 | 5.53±2.43 |
| Rx.B.L | 5.05±2.35 | 4.15±2.46 | 5.01±1.98 | 4.25±2.36 | 4.52±1.81 | 4.98±1.95 | 4.78±2.28 | 4.86±2.60 |
| Correlation Coefficient(r) | 0.782** | 0.816** | 0.819** | 0.815** | 0.732** | 0.759** | 0.794** | 0.838** |
| Tooth type. / measuremetns | 47(89) mean±S.D | 46(114) mean±S.D | 45(63) mean±S.D | 44(62) mean±S.D | 34(73) mean±S.D | 35(75) mean±S.D | 36(115) mean±S.D | 37(95) mean±S.D |
| A.L | 4.91±1.54 | 4.65±1.68 | 3.89±1.35 | 3.66±1.28 | 3.48±1.25 | 3.87±1.39 | 4.43±1.30 | 4.39±1.31 |
| Rx.B.L | 4.96±1.71 | 3.86±1.87 | 4.21±1.87 | 4.20±1.96 | 3.96±1.34 | 4.31±1.61 | 4.43±1.30 | 4.51±1.52 |
| Correlation Coefficient(r) | 0.896** | 0.915** | 0.756** | 0.749** | 0.828** | 0.838** | 0.860** | 0.899** |

A.L : Probing Attachment loss
Rx.B.L : Radiographic Bone Level
** : $p<0.01$

exception in UR1M with $r=0.257$ and UL1M with $r=0.225$.

The correlation between A.L(c) and Rx.B.L(f) :

Table 4 The comparison between P.D(c) and Rx.B.L(f) in molar teeth with furcation

| Tooth type. / measuremetns | 16(41) | 17(35) | 26(45) | 27(25) | 36(53) | 37(27) | 46(55) | 47(35) |
|---|---|---|---|---|---|---|---|---|
| | mean±S.D | mean±S.D | mean±S.D | mean±S.D | mean±S.D | mean±S.D | mean±S.D | mean±S.D |
| P.D(c) | 4.53±2.14 | 4.65±2.02 | 4.37±2.08 | 5.35±2.38 | 7.11±2.21 | 6.53±1.79 | 5.86±2.16 | 5.84±2.04 |
| Rx.B.L(f) | 0.63±1.63 | 0.41±1.50 | 0.25±0.73 | 0.43±1.06 | 2.01±11.52 | 1.58±1.03 | 1.81±1.41 | 2.05±1.30 |
| Correlation Coefficient(r) | 0.257 | 0.502** | 0.225 | 0.672** | 0.811** | 0.668** | 0.761** | 0.435** |

P.D.(c) : Clinical probing of pocket depth at middle site
Rx.B.L(f) : Radiographic bone level from the roof of the furca
** : $p<0.01$

Table 5 The comparison between A.L(c) and Rx.B.L(f) in molar teeth with furcation

| Tooth type. / measuremetns | 16(41) | 17(35) | 26(45) | 27(25) | 36(53) | 37(27) | 46(55) | 47(35) |
|---|---|---|---|---|---|---|---|---|
| | mean±S.D | mean±S.D | mean±S.D | mean±S.D | mean±S.D | mean±S.D | mean±S.D | mean±S.D |
| A.L(c) | 4.64±2.02 | 4.69±1.69 | 4.46±2.20 | 5.42±2.20 | 8.06±2.14 | 6.57±1.95 | 5.94±2.08 | 6.97±2.36 |
| Rx.B.L(f) | 0.63±1.63 | 0.41±1.50 | 0.25±0.73 | 0.43±1.06 | 2.01±1.52 | 1.58±1.03 | 1.81±1.41 | 2.05±1.30 |
| Correlation Coefficient(r) | 0.113 | 0.582** | 0.162 | 0.752** | 0.906** | 0.896** | 0.837** | 0.479** |

A.L(c) : Clinical probing of attachment loss at middle site.
Rx.B.L(f) : Radiographic bone level from the roof of the furca.
** : $p<0.01$

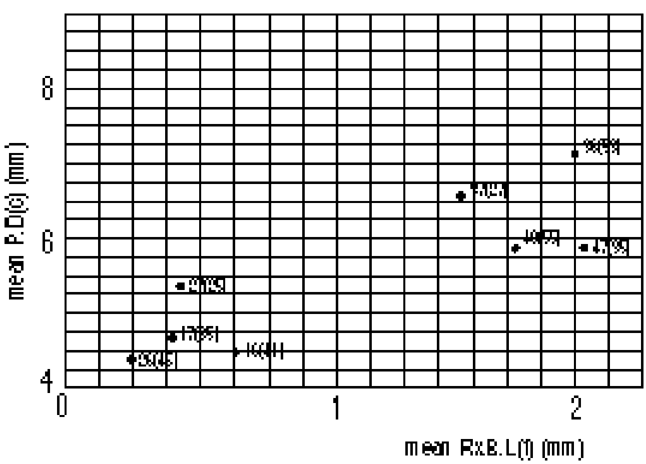



Fig 2 The relationship between the mean of radiographic bone level and mean of pocket depth in molars with furcation involvement

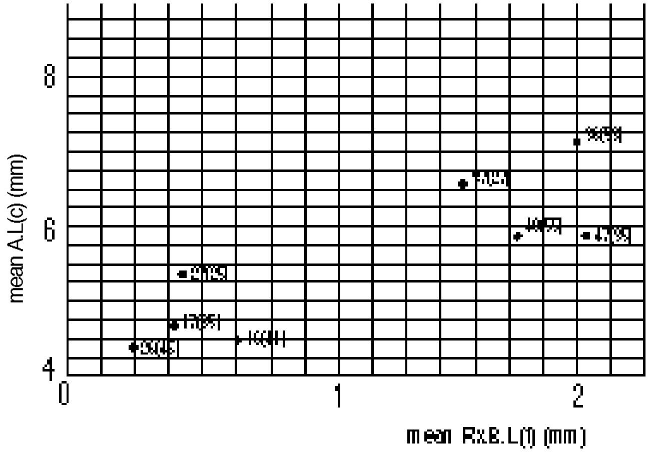



**Fig 3 The relationship between the mean of radiographic bone level and mean of attachment loss in molars with furcation involvemrnt**

The mean values and the correlation are showed in table 5. The coeffient of correlation was very high (from r=0.906 to r=0.479. (p<0.01)) for the exception in UR1M with r=0.113 and UL1M with r=0.162.

A total of 1,422 teeth, 653 premolars and 769 molars (excluding third molars) were measured. Of the total 356 upper molars, 146 (40%) presented furcation involvement and of the total 413 lower molars, 170 (41%) presented furcation involvement.

## IV. DISCUSSION

Pocket depth(P.D) and attachment loss (A.L) were measured on 3613 surfaces.

The reproducibility was better for shallow pockets in compared to deeper pockets[23]. There are a number of the variables that affect probing measurements[19, 22, 23, 25, 29]. Although the precision of pocket depth measurement or in other words the intra-examiner reproducibility did not increase after training together with standardization of the pocket force[19], care should be taken with the interpretation of the results from this study since the measurements were carried out by more than one examiner. Probing P.D and A.L may be assessed to approximately the same degree of accuracy[20]. The periodontal Williams probe used in this study was very accurate in determining attachment level[30].

Loss of attachment refers to the part of the roof which no longer has periodontal fibers attached to the cementum, and which may either be exposed or covered by pocket epithelium. It follows that when the gingival margin was located on the enamel P.D and A.L may quantitatively coincide, however if cases with gingival recession or gingival inflammation are included, large discrepancies between P.D and A.L may exist. The method errors for measuring P.D and A.L appears that no major differences exists but the gingiva may be subject to recession and hyperplastic changes. This means that P.D does not necessarily correspond to the amount of periodontal destruction.

Lately, clinical measurements of loss of attachment has been systematically utilized to express the degree of severity of periodontal destruction[3]. Although the cementoenamel junction may be difficult to locate in some instances, it is a reliable landmark.

Three primary assessments serve to indicate the present of periodontal disease, P.D and A.L by clinical measurements and bone loss by radiographic measurement. Greenberg J. et al[31] proposed a technique pushing through the gingival tissue as a sounding device undergo with local anesthesia, to determine the shape of bone defects.

The correlation between clinical and radiographic measurements in interproximal area :

There is a reason to question whether attachment loss measurement have any direct relationship to bone loss. In this study reveled a high coefficient of correlation and were statistically significant at the 0.01 level. This coefficient express the correlation between the subject mean attachment loss and the subject mean bone loss. The results of this study were similar with those of Hausmann[18] who found a direct and significant relationship expressed by a regression line($r^2=0.17$) and a concordance of radiographic and attachment loss in 82% of sites examined. Jeffcoat (1992)[32] had recently compared alveolar bone change by subtraction radiography with changes in clinical attachment and reported a high concordance at 77%.

Kelly study[33] said that radiographic assessment of bone was positively correlated with, pocket depth and the level of attachment. In Suomi[12] results indicate that radiographs are useful for an accurate evaluation of the level of alveolar bone but that clinical measurements of the attachment level yield an equally accurate assessment of the periodontal destruction.

Since measurements on radiographs require more time, equipment, money, projection angle, exposure time, film development taken under control and standardized conditions, such condition do not currently exist in the practice of periodontics, it is reasonable to assess periodontal destruction in clinical trials on the basis of clinical attachment level measurements as reported by Ramfjord (1959)[3] and Glavind & Loe (1967)[20].

The correlation between clinical and radiographic measurements in furcation area :

Vertical probing measurements were performed at the middle site and the radiographic measurement was assessed by the radiolucency space from the roof of the furca.

There are a number of factors that can contribute to periodontal breakdown in furcal area[34, 35]. Tarnow[36] reported a subclassification of furcation involvement to help the practitioner assess the amount of support a furcation teeth might have in a more quantitative perspective. Since this vertical component can have even more bearing upon the ultimate restorability and prognosis of a teeth than the horizontal component. The vertical bone loss from the roof of the furcation apically was the mean point taken into account. Numerous studies have shown that the diagnostic accuracy of dental radiography for periodontal diagnosis is limited and that radiographs, even when high quality, can only provide a general overview of the extent of the disease[8]. There are only a few studies evaluating the radiographic interpretation of furcation defects. Rees and co-workers[14] reported that 129 out of 150 furcation defects on dried skulls were discernible. Gürgan C. et al[37], in their experimental study of radiographic detectability of bone loss, found that the bone loss in the intra-radicular area of molars was high except for lesions corresponding to a initial periodontal furcation involvement.

Goodson et at (1984)[38] addressed the relationship between both parameters but only for 10 site in 6 subjects. They suggest that probe attachment loss precede radiographic bone loss. His study indicate that net loss of both attachment and bone may occur by repeated cycles of loss and incomplete recovery. Thus, periodontal destruction does not appear to be a continuous process, but is characterized by periods of episodic activity and that radiographic evidence of periodontal bone loss generally follows attachment change by periods of 6 months or more and occurs during the period of remission of attachment loss.

In this present study, the correlation between both was high in almost all teeth in accordance with the results from other studies[18, 33]. Goodson[38] supported that, the attachment loss predicts bone loss with a high probability when the attachment loss measurement precedes the bone loss measurement. However, Renvert et at (1981)[16] found a weak correlation($r = 0.4$). In this present study showed in upper first molars a weaker correlation than in second molars. The mean furcation entrance dimensions in maxillary first molars was significantly greater than those of maxillary second molars[39-41] and the presence of a mixture of convexities and concavities in shape, make difficult to obtain a accurate radiographic interpretation due to the superimposition giving a severe underestimation of bone loss.

Several factor, singularly or in various combinations, may contribute to the difference coefficient of correlation such a possible time lag may exist between attachment loss and radiographic bone loss as reported by Goodson (1984)[38]. In this present study did not provide any information about the time relationship between attachment and radiographic bone changes because onlay one time period was examined.

The temporal relationship between cyclic variation in attachment level and radiographic evidence of bone loss is of interest in the elucidation of sequential steps in the disease process. Furthermore the most frequent site of early periodontal disease, without radiographic evidence, is in the mesial surface of the maxillary[26, 42, 43]. Study by Ramandan[44] concluded that bifurcation and trifurcation defects did not produce x-ray evidence unless reduction in height of the alveolar crest had occurred. Haim Tal[45] reported a high correlation between the depths of furcal defects and loss of related alveolar bone height, and finally supported that when the alveolar bone crest to C.E.J. distance is 5 to 6mm or more the buccal surfaces of the molar teeth, furcal lesions should be suspected.

The measurement of clinical attachment loss in furcation site was the vertical probing and its has to be considered the possibility of a clinical overestimation of furcation which suggested greater defect depth than the true measurements identified. The probing of untreated molar furcation sites does not measure the attachment level of the intraradicular root surfaces, but rather records the depth of probe penetration into the inflammed furcation connective tissue, and there was no correlation between the degree of inflammation and the depth of probe penetration[3, 46-48].

## V. CONCLUSION

The purpose of this study was to evaluate the relationship between parameters frequently used in daily practice measuring pocket depth (P.D) and attachment loss(A.L) by clinical manual probe and bone level by radiographic measurement (Rx.B.L.).

A total of 1,422 teeth, 653 premolars and 769 molars(excluding third molars) from 130 patients were measured.

Clinical measurements were scored the mesial and distal site of premolar and the mesial, middle and distal site of molar recording the deepest site from the buccal and lingual. Probing pocket depth was measured the distance from the gingival margin to the base of the pocket and probing attachment loss was measured the distance from the cementoenamel junction to the base of the pocket.

Radiographic measurement was made to assess bone loss by measuring the distance from C.E.J. to the alveolar crest.

Assessment to the furcation area , vertical P.D and A.L were performed in the middle site and the bone level was measured the radiolucency space from the roof of the furca to the interalveolar crest. From the obtained data of the clinical and radiographic parameters we evaluated the correlation between both parameters.

The results were as the follows :

1. The correlation between P.D and Rx.B.L in interproximal site was showed high in all teeth(from $r=0.897$ to $r=0.725$, $p<0.01$).
2. The correlation between A.L and Rx.B.L in interproximal site was showed high in all teeth(from $r=0.915$ to $r=0.732$, $p<0.01$).
3. A total of 769 molars(excluding third molars) were measured. Of the total 356 upper molars, 146(40%) presented furcation involvement and of the total 413 lower molars, 170(41%) presented furcation involvement.
4. The correlation between P.D at the middle site and Rx.B.L at the furca in molars with furcation involvement was showed high in all teeth(from $r=0.811$ to $r=0.435$, $p<0.01$), for the exception in upper first molars.
5. The correlation between A.L at the middle site and Rx.B.L at the furca molars with furcation involvement was showed high in all teeth(from $r=0.906$ to $r=0.479$, $p<0.01$), for the exception in upper first molars.

These results suggest that the radiographic measurement has a high correlation to the clinical measurements, and can contribute significantly in the diagnosis and management of periodontal disease.

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# 소구치 및 대구치의 치주임상지수와 방사선학적 측정과의 상관관계에 대한 연구

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치주상태의 진단은 일반적으로 치주탐침과 같은 임상적 검사와 보조적으로 방사선 검사를 이용한다. 방사선학적인 검사가 치주조직의 파괴정도와 골 흡수를 진단하는데 유용하지만 실제적인 골 흡수를 정확하게 나타나는데는 한계가 있다고 하였다. 그리고 임상적 측정과 방사선 사진을 비교연구하여 이들간의 관계를 알아보고자 하는 노력이 있었다. 방사선이 임상에서 참고사항으로는 중요하지만 절대적 신뢰를 주는데는 문제가 있는 것으로 생각되어왔다.

방사선학적 측정과 임상지수 측정간의 상관관계에대하여 계속적인 연구를 통해 규명하는것이 중요하다고 생각되어 저자는 연세대학교 치과 대학병원 치주과를 내원한환자중 연령 및 성별에 관계없이 전신질환이 없는 환자 130명을 대상으로 소구치의 원 · 근심부, 대구치의 원 · 중 · 근심부에서 치주낭의 깊이와 (P.D), 부착상실 (A.L)을 측정하였다. 방사선 사진상의 원 · 근심부에서 백악 법랑질 경계부에서 치조골능 상부까지의 치조골 수준 (Rx.B.L)을 측정하였고 이개부 부위에서는 이개부의 천정으로부터 나타나는 골 흡수의 방사선 투과상을 측정하였다. 이를 기초로 임상지수와 방사선학적 측정간에 상관관계를 연구하여 다음과 같은 결론을 얻었다.

1. 원 · 근심부의 P.D와 Rx.B.L을 비교 했을 때 상관관계는 모든 치아에서 높게 나타났다( $r = 0.897$ $r = 0.725$, $p<0.01$).
2. 원 · 근심부의 A.L와 Rx.B.L을 비교 했을 때 상관관계는 모든 치아에서 높게 나타났다 ( $r = 0.915$ $r = 0.732$, $p<0.01$ ).
3. 대구치 769개가 실험 대상인었다. 상악 대구치중(356개) 40%가 이개부 병소를 나타냈고 (146개), 하악 대구치중(413개) 41%가 이개부 병소를 나타냈다(170개).
4. 대구치의 이개부 병소의 중앙부에서 측정한 P.D와 Rx.B.L을 비교 하였을 때 상관관계는 상악 제1대구치를 제외한 모든 치아에서 높게 나타 났다($r = 0.811$ $r = 0.435$, $p<0.01$).
5. 대구치의 이개부 병소의 중앙부에서 측정한 A.L와 Rx.B.L을 비교 하였을 때 상관관계는 상악 제1대구치를 제외한 모든 치아에서 높게 나타 났다($r = 0.906$ $r = 0.479$, $p<0.01$).

이상의 결과를 종합하여 볼 때 임상지수와 방사선학적 측정을 비교한 바, 이들의 상관관계는 모든 치아에서 밀접하게 나타났다. 따라서 방사선학적 측정은 임상지수와 더불어 치주질환의 진단과 치료계획에 크게 기여할 수 있을 것으로 사료된다.

핵심 되는 말 : 치주낭 측정깊이, 부착상실 측정, 방사선학적 측정깊이